served in November and again in January, indicating that some pulses of toxicity are flowing from the western end of the delta and into the northern estuary, although the duration of the toxicity was very short. A more significant pulse of toxicity was observed in February, in which the toxicity appeared to be present in the bay for at least three days, and possibly for as long as six days.

Interestingly, the mysid toxicity in November and January was in ambient water in which diazinon and chlorpyrifos were both below the method detection limits (~50 ng/L), indicating that the observed toxicity was due to other contaminants. In the case of the extended toxicity observed in February, the water samples collected on February 14, 17, and 19 all had measured diazinon and chlorpyrifos concentrations below the detection limits. However, the water samples collected February 6, 10, and 12 (immediately prior to the toxic water samples) exhibited progressively increasing diazinon concentrations (from 55 ng/l on the February 5 to 116 ng/L on the February 12) indicating that a pulse of diazinon contamination passed through the system immediately prior to the toxic samples. This in turn suggests that a runoff-related pulse of contaminants, some of which reached northern estuary immediately following the diazinon peak, was in fact responsible for the extended toxicity that was observed.

Pacheco Slough. Two of the eight water samples collected at Pacheco Slough were toxic to the mysids, both of which had organophosphate pesticide levels either below the detection limits (in the case of chlorpyrifos) or below the concentration reported to be toxic to *Mysidopsis bahia* (in the case of diazinon). The first toxic sample occurred in early December. The second sample occurred in January at approximately the same time as toxicity was being observed just upstream at Mallard Slough, suggesting that the observed toxicity may have been due to the same contaminants responsible for the upstream toxicity. Our sampling at Pacheco Slough has admittedly been 'hit or miss' with respect to catching contaminant pulses associated with the storm water runoff (the hydrology at this site has yet to be characterized, especially with respect to movement and timing of storm water runoff). Nevertheless, every sample that we have collected from this site has had measurable levels of diazinon, suggesting the presence of a long-term source (e.g., sediments) within the watershed.

South Bay (Guadalupe Slough). Unlike the previous year in which elevated concentrations of chlorpyrifos in storm water runoff were associated with occurrences of toxicity to mysids, there has been no measurable chlorpyrifos or toxicity in any of the Guadalupe Slough water samples collected this winter.

Table 2. Summary of South Bay RMP Episodic Toxicity Pilot Study Testing Results (1996-97)

Site	Sample Collection Date	% Mysid Survival		ELISA Analyses	
		Control	Site Water	Diazinon (ng/L)	Chlorpyrifos (ng/L)
Guadalupe Slough (2 ppt salinity)	10—29—96	97.5	0*	392	145
Guadalupe Slough(4 ppt salinity)	10—29—96	97.5	92.5	b.d.	b.d.
Guadalupe Slough	11—17—96	100	90	n.m.	n.m.
Guadalupe River	11—17—96	100	97.5	n.m.	n.m.
Guadalupe Slough	12—10—96	100	95	176	b.d.
Guadalupe River	12—10—96	100	95	515	67
Guadalupe Slough	1—2—97	100	95	b.d.	b.d.
Guadalupe River	1—2—97	100	95	b.d.	b.d.
Guadalupe Slough	3—17—97	97.5	95	b.d.	b.d.
Alviso Slough	3—17—97	97.5	90	b.d.	b.d.
Guadalupe Slough	4—19—97	95	0*	b.d.	78
Guadalupe River	4—19—97	95	82.5	b.d.	67
Guadalupe Slough	5—23—97	97.5	47.5*	b.d.	70
Guadalupe Rive	5—23—97	97.5	82.5	b.d.	63
Guadalupe Slough	6—4—97	95	100	54	*
Guadalupe River	6—4—97	95	100	74	*

n.m. not measured.
b.d. below detection limits.
* inconsistent results for chlorpyrifos analyses.

Future Plans

The wet seasons of 1996—97 and 1997—98 were both anomalous. In 1998, application of pre-emergent pesticides was disrupted due to an extremely wet February. In addition, the high water flows most likely diluted any pesticide runoff from the agricultural areas of the Central Valley, so that fewer toxic events were observed than during a wet season with low or normal runoff. This is supported by observation of fewer instances of ambient water toxicity upstream as well (Val Connor, personal communication). Therefore, it is probably prudent to maintain the existing sampling scheme in 1998—99.

Given that the RMP baseline toxicity testing has detected ambient water toxicity in summer months as well, it may be desirable to extend such monitoring and toxicity testing throughout the year. Funding to extend the current monitoring for the remaining six months of the year was requested in the 1997 round of CALFED funding, but was turned down. A renewed request for the necessary funding will be resubmitted in any future CALFED funding cycles.

Furthermore, the observation of ambient water toxicity in summer and in winter samples without measurable levels of diazinon or chlorpyrifos is not explained by our current working hypothesis of ambient water toxicity due to seasonal runoff of pesticides. As a result, it would also be desirable to investigate and determine the causes of such toxicity through the application of toxicity identification and evaluation (TIE) methods.

In the South Bay, the focus will continue to be on toxicity due to urban storm water runoff. ELISA analysis of runoff waters collected last season clearly demonstrated that the practice of "grab" samples is 'hit or miss' with respect to catching the peak pesticide concentrations. Therefore, we are proposing to collect composite samples using an autosampler. The on-line access to the runoff monitoring system of the Santa Clara Valley Water District to determine when significant runoff occurs, will enable remote activation of the autosampler to collect composite samples over a 24-hour period. These water samples will be transported to the testing laboratory in Martinez, where diazinon and chlorpyrifos levels will be determined using ELISA, and toxicity evaluated as before.

References

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X2 Workshop Summary

Wim Kimmerer, SFSU

On March 11, the IEP and the Bay/Delta Modeling Forum sponsored a workshop at Contra Costa Water District in Concord to discuss issues related to the X2 standards and the relationships between X2 and various measures of abundance and survival of fish and invertebrates. X2 is the distance up the axis of the estuary to where tidally-averaged near-bottom salinity is 2 psu. It is considered a measure of physical response of the estuary to changes in freshwater flow, and is being used as a standard for managing the estuary.

A full report about the workshop will be in a future issue of the *Newsletter*. This summary is intended merely as a brief overview of the workshop and the general content of the discussion.

The one-day workshop consisted of presentations by speakers and a panel discussion. Speaker presentations were held in the morning. The following is a list of the presentations and the speakers.

- Introduction—Randy Brown
- Brief History of the Schubel Workshops—Wim Kimmerer
- History of Development of the X2 Standard—Bruce Herbold
- Physics of the Low-Salinity Zone of the Estuary—Jon Burau
- Current Status of the "Fish-X2" Relationships—Wim Kimmerer
- Possible Mechanisms Underlying the Fish-X2 Relationships and Policy Considerations—BJ Miller

The afternoon panel discussion was wide-ranging, and included such topics as future research needs and possible alternatives to X2 as a standard.